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ADP010471

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ADP010453 thru ADP010473

Polyphasic Sleep and Napping Strategies

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Sleep deprivation is the most detrimental stressfactor for mental performance during continuous military operations. First of all it affects all subjective parameters such as well-being, mood state, motivation, creativity, care for others or social surplus. These changes are followed by alterations in psychometric performance tests such as vigilance tasks, with increasing number of omissions, complex tasks, cognitive functions, reduced reaction speed and learning capacity. When sleep is totally denied for several days more serious neurological symptoms appear such as slow motion, balance disturbance, nystagmus, headache, visual hallucination and sleep narcosis. All this symptoms are most apparent during night-time.

The amount of sleep necessary to prevent performance decrement in various tasks during continuous operations depends on the tasks to be done and the time of day. In addition there are big variations between individuals. Generally it is assumed that 1-2 hour of sleep each night is sufficient to avoid the most serious neurological symptoms during continuous operations lasting for approximately one week. If the mental function as expressed in the psychometric performance tests is to be preserved 2-4 hours of sleep may be necessary. If also the subjective parameters such as well-being, mood-state, motivation, creativity, are to be preserved almost normal sleep time is required. If the military operation is extended more sleep is needed at all levels to prevent performance decrement.

The experiment with the dancer running for the Guinness world record in marathon swing dance, showed that only 5 minutes of sleep each hour was sufficient to extend the dancers performance from 60 to 110 hours of continuous swing dance without severe neurological symptoms.

Use of hypnotics are very rarely necessary in sleep deprived subjects because they very easily fall asleep particularly during night time. In addition, hypnotics would also affect the subject's readiness. Amphetamine and similar drugs are stimulating the cerebral adrenergic neurotransmission leading to increased alertness for a certain period but followed by more pronounced exhaustion level afterward.

It is well documented that naps increase your performance or prevent further decrease during periods of sleep deprivation and in contrast to amphetamine naps restore mental function (Angus et al 1987, Opstad et al 1978). A question is how short a nap can be and still have restorative effect? For the dancer 5 minutes periods was demonstrated to be efficient. Even periods with micro-sleep that are almost impossible to avoid during prolonged periods with sleep deprivation may have a restorative effect. Even the hallucinations that have many similarities with dreams and sleep related cerebral activities may have restorative effects because the cadets rarely hallucinate on 2 consecutive nights. In addition the hallucinations are connected to the level of activation, since those cadets with high workload like the leaders do very rarely

hallucinate. The typical cadets who hallucinate are a common member of the platoon that do not have any demanding tasks. The hallucinations are therefore more a blow-out preventer than a sign of pathology.

The problems with sleep inertia are in most cases short-lasting and can be overcome with high physical activities just after the sleep period. After 2 hours and 20 minutes sleep the cadets who had to run for 30 minutes had significantly better mental performance than those who were transported by lorry (Opstad et al unpublished). By overlearning the tasks that are going to be done immediately after the sleep period one might be able to keep a high physical work-load and by that reduce the sleep inertia period.

Angus RG, Hesselgrave RJ, Pigeau RA, Jamieson DW (1987): Psychological performance during sleep loss and continuous mental work: effects of interjected naps, Proceeding of the 27th DRG Seminar; Sleep and its Implications for the Military, Lyon pp 81-102.

Opstad PK, Ekanger R, Nummestad M, Raabe N (1978): Performance, mood and clinical symptoms in man exposed to prolonged severe physical work and sleep deprivation, Aviat Space and Environ Med 49, 1065-1073.